Customer No.: 31561
Application No.: 10/708,203
Docket No.: 11114-US-PA

AMENDMENTS

In The Claims

1. (currently amended) A light emitting diode (LED) device, comprising:

a device substrate;

a first doped layer, formed on the device substrate;

a light emitting layer, formed on the first doped layer;

a second doped layer, formed on the light emitting layer, wherein the second doped layer and the first doped layer are comprised of a semiconductor material of a III-V group compound with different conductivity type;

a strained-layer superlattice contact layer

a transparent conductive oxide layer as an ohmic contact layer, wherein the transparent conductive oxide layer is deposited on the strained-layer superlattice contact layer, wherein a thickness of the transparent conductive oxide layer is $(2m+1)\lambda/2n$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and n is a refractive index of the transparent conductive oxide layer;

a reflecting layer, deposited on the transparent conductive oxide layer; and

two electrodes, formed on the reflecting layer and a portion of the first doped layer, respectively.

2. (cancelled)

3. (original) The LED device of claim 1, wherein the strained-layer superlattice contact layer comprise n-type or p-type III-V semiconductor multi-layer structures.

4. (original) The LED device of claim 1, wherein the semiconductor material of the III-V group compound is gallium nitride (GaN), gallium phosphide (GaP) or gallium phosphide arsenide (GaAsP).

5. (original) The LED device of claim 1, wherein the light emitting layer comprise a quantum-well light emitting layer.

6. (original) The LED device of claim 1, wherein a material of the transparent conductive oxide layer is indium tin oxide (ITO), cerium tin oxide (CTO), antimony tin oxide (ATO), aluminum zinc oxide (AZO) indium zinc oxide (IZO), zinc oxide (ZnO), cadmium tin oxide, $ZnGa_2O_4$, SnO_2:Sb, Ga_2O_3:Sn, $AgInO_2$:Sn, In_2O_3:Zn, $CuAlO_2$, LaCuOS, NiO, or $CuGaO_2$, $SrCu_2O_2$.

7. (original) The LED device of claim 1, wherein the first doped layer is comprised of a N-type doped layer, and the second doped layer is comprised of a P-type doped layer.

8. (original) The LED device of claim 1, wherein the first doped layer is comprised of a P-type doped layer, and the second doped layer is comprised of a N-type doped layer.

9. (original) A light emitting diode (LED) device, comprising:

a device substrate;

a first doped layer, formed on the device substrate;

a light emitting layer, formed on the first doped layer;

a second doped layer, formed on the light emitting layer, wherein the second doped layer and the first doped layer are comprised of a semiconductor material of a III-V group compound with different conductivity type;

a strained-layer superlattice contact layer;

a transparent conductive oxide layer as an ohmic contact layer, wherein the transparent conductive oxide layer is deposited on the strained-layer superlattice contact layer;

a transparent insulating layer as a passivation layer, wherein the transparent insulating layer is deposited on transparent conductive oxide layer;

a reflecting layer, deposited on the transparent insulating layer and a portion of the transparent conductive oxide layer; and

two electrodes, formed on the reflecting layer and a portion of the first doped layer, respectively.

10. (original) The LED device of claim 9, wherein a thickness of the transparent conductive oxide layer is $(2m+1)\lambda/2n$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and n is a refractive index of the transparent conductive oxide layer.

11. (currently amended) The LED device of claim 9, wherein a thickness of the transparent insulating layer is $(2m+1)\lambda/2k$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and k is a refractive index of the transparent insulating layer.

12. (original) The LED device of claim 9, wherein the strained-layer superlattice contact layer comprise n-type or p-type III-V semiconductor multi-layer structures.

13. (original) The LED device of claim 9, wherein the semiconductor material of the III-V group compound is gallium nitride (GaN), gallium phosphide (GaP) or gallium phosphide arsenide (GaAsP).

14. (original) The LED device of claim 9, wherein the light emitting layer comprise a quantum-well light emitting layer.

15. (original) The LED device of claim 9, wherein a material of the transparent conductive oxide layer is indium tin oxide (ITO), cerium tin oxide (CTO), antimony tin oxide (ATO), aluminum zinc oxide (AZO) indium zinc oxide (IZO), zinc oxide (ZnO), cadmium tin oxide, $ZnGa_2O_4$, SnO_2:Sb, Ga_2O_3:Sn, $AgInO_2$:Sn, In_2O_3:Zn, $CuAlO_2$, LaCuOS, NiO, or $CuGaO_2$, $SrCu_2O_2$.

16. (original) The LED device of claim 9, wherein a material of the transparent conductive oxide layer is SiO_2, SiN_x, Al_2O_3, AlN, BeO, ZnO.

17. (original) The LED device of claim 9, wherein the first doped layer is comprised of a N-type doped layer, and the second doped layer is comprised of a P-type doped layer.

18. (original) The LED device of claim 9, wherein the first doped layer is comprised of a P-type doped layer, and the second doped layer is comprised of a N-type doped layer.

19. (currently amended) A flip-chip light emitting diode (LED) package structure, comprising:

a package substrate; and

a LED device, faced-down and flipped on the package substrate and electrically connected to the package substrate, wherein the LED device comprises:

a device substrate;

a first doped layer, formed on the device substrate;

a light emitting layer, formed on the first doped layer;

a second doped layer, formed on the light emitting layer, wherein the second doped layer and the first doped layer are comprised of a semiconductor material of a III-V group compound with different conductivity type;

a strained-layer superlattice contact layer

a transparent conductive oxide layer as an ohmic contact layer, wherein the transparent conductive oxide layer is deposited on the strained-layer superlattice contact layer, wherein a thickness of the transparent conductive oxide layer is $(2m+1)\lambda/2n$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and n is a refractive index of the transparent conductive oxide layer;

a reflecting layer, deposited on the transparent conductive oxide layer; and

two electrodes, formed on the reflecting layer and a portion of the first doped layer, respectively.

20. (cancelled)

21. (original) A flip-chip light emitting diode (LED) package structure, comprising:

a package substrate; and

a LED device, faced-down and flipped on the package substrate and electrically connected to the package substrate, wherein the LED device comprises:

a device substrate;

a first doped layer, formed on the device substrate;

a light emitting layer, formed on the first doped layer;

a second doped layer, formed on the light emitting layer, wherein the second doped layer and the first doped layer are comprised of a semiconductor material of a III-V group compound with different conductivity type;

a strained-layer superlattice contact layer;

a transparent conductive oxide layer as an ohmic contact layer, wherein the transparent conductive oxide layer is deposited on the strained-layer superlattice contact layer;

a transparent insulating layer as a passivation layer, wherein the transparent insulating layer is deposited on transparent conductive oxide layer;

a reflecting layer, deposited on the transparent insulating layer and a portion of the transparent conductive oxide layer; and

two electrodes, formed on the reflecting layer and a portion of the first doped layer, respectively.

22. (original) The flip-chip LED package structure of claim 21, wherein a thickness of

the transparent conductive oxide layer is $(2m+1)\lambda/2n$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and n is a refractive index of the transparent conductive oxide layer.

23 (original) The flip-chip LED package structure of claim 21, wherein a thickness of the transparent insulating layer is $(2m+1)\lambda/2k$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and k is a refractive index of the transparent insulating layer.

24. (original) A light reflective structure for a light emitting diode (LED), comprising:

a transparent conductive oxide layer deposited on a semiconductor layer;

a transparent insulating layer deposited on the transparent conductive oxide layer; and

a reflecting layer deposited on the transparent insulating layer.

25. (original) The light reflective structure of claim 24, wherein a thickness of the transparent conductive oxide layer is $(2m+1)\lambda/2n$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and n is a refractive index of the transparent conductive oxide layer.

26 (original) The LED device of claim 24, wherein a thickness of the transparent insulating layer is $(2m+1)\lambda/2k$ (m is 0 or a positive integer), wherein λ is a wavelength of a light emitted from the light emitting layer and k is a refractive index of the transparent insulating layer.